

## APPENDIX I

# GLOSSARY

**AMPLIFIER**—The device that provides amplification (the increase in current, voltage, or power of a signal) without appreciably altering the original signal.

**ANNUNCIATOR**—An electrical signaling device that displays a visual indication, usually a flashing light.

**APPROACH LIGHTS**—A configuration of ground lights located in the extension of a runway before the threshold to provide visual approach and landing guidance to pilots.

**AUTOMATIC FIRE ALARM SYSTEM**—A system using fire detectors, such as heat, smoke, and flame detectors, to initiate alarms automatically.

**BALLAST**—A device used with an electric-discharge lamp to obtain the necessary circuit conditions (voltage, current, and waveform) for starting and operating.

**BASE**—The element in a transistor that controls the flow of current carriers.

**CANDELA (FORMERLY CANDLE)**—The unit of luminous intensity used to measure the intensity of light radiated from a light source. It is the average luminous intensity of the international candle. This intensity is usually expressed as CANDLEPOWER instead of as candles of luminous intensity.

**CATHODE**—The negative terminal of a forward-biased semiconductor diode, which is the source of the electrons.

**CATHODE-RAY TUBE (CRT)**—An electron tube which has an electron gun, a deflection system, and a screen. This tube is used to display visual electronic signals.

**COEFFICIENT OF UTILIZATION**—Concerning the light from a luminaire, the ratio of lumens received on the work plane to the lumens emitted by the luminaire lamp.

**COLLECTOR**—The element in a transistor that collects the current carriers.

**COMMON BASE**—A transistor circuit in which the base electrode is the element common to both the input and the output circuits.

**COMMON COLLECTOR**—A circuit configuration in which the emitter is the element common to both the input and the output circuits.

**DIELECTRIC**—A nonconductor of electricity; an insulator or insulating material.

**DIFFUSER**—A device to redirect or scatter the light from a source.

**DIODE**—A two-element solid-state device made of either germanium or silicon. It is primarily used as a switching device.

**DONOR**—An impurity that can make a semiconductor material an N-type by donating extra “free” electrons to the conduction band.

**DOPING**—The process of adding impurities to semiconductor crystals to increase the number of free charges that can be moved by an external, applied voltage. Doping produces N-type or P-type materials.

**DUSTPROOF LUMINAIRE**—A luminaire so constructed or protected that dust will not interfere with its successful operation.

**DUST-TIGHT LUMINAIRE**—A luminaire so constructed that dust will not enter the enclosing case.

**ELECTRIC-DISCHARGE LAMP**—A lamp in which light is produced by the passage of an electric current through a vapor or a gas.

**EMERGENCY LIGHT**—Lighting designed to supply illumination essential to safety of life and property in the event of failure of the normal light.

**EMITTER**—The element in a transistor that emits current carriers (electrons or holes).

**EXPLOSION-PROOF LUMINAIRE**—A completely enclosed luminaire capable of withstanding an explosion within it and preventing the ignition of a gas or vapor surrounding the enclosure by sparks, flashes, or explosion. The external temperature at which it is operated must be such that a surrounding flammable atmosphere will not be ignited.

**FIELD-EFFECT TRANSISTOR (FET)**—A transistor consisting of a source, a gate, and a drain. Current flow is controlled by the transverse electric field under the gate.

**FLOODLIGHT**—A system designed for lighting a scene or an object to a luminance greater than that of its surroundings.

**FLUORESCENT LAMP**—A low-pressure mercury electric-discharge lamp in which a fluorescing coating on its inner surface transforms some of the ultraviolet energy generated by the discharge into light.

**FLUORESCENT-MERCURY LAMP**—An electric-discharge lamp having a high-pressure mercury arc in an arc tube and an outer envelope coated with a fluorescing substance that transforms some of the ultraviolet energy generated by the arc into light.

**FOOTCANDLE**—The illumination intensity or luminous density on a surface 1 foot distant and perpendicular to the rays emitted by a light source of 1 candlepower.

**FORWARD BIAS**—An external voltage that is applied to a PN-junction in the conducting direction so that the junction offers only minimum resistance to the flow of current. Conduction is by the majority current carriers (holes in P-type material; electrons in N-type material).

**FULL-WAVE RECTIFIER**—A circuit that uses both positive and negative alternations in an alternating current to produce direct current.

**GENERAL-PURPOSE FLOODLIGHT**—A weatherproof fixture so constructed that the housing forms the reflecting surface. The assembly is enclosed by a glass cover.

**GIN POLE**—An upright guy pole with hoisting tackle and a foot-mounted snatch block used for vertical lifts.

**GLARE**—Light from a source or a reflecting surface that interferes with proper vision or causes eye discomfort. The amount of glare depends on the brightness of the light source, the contrast between the source and the background, and the location of the light source in respect to the field of vision.

**GROUND**—A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth.

**GROUNDING CONDUCTOR**—A conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode.

**GROUNDING ELECTRODE**—A conductor embedded in the earth for maintaining ground potential on conductors connected to it.

**HALF-WAVE RECTIFIER**—A rectifier using only one-half of each cycle to change alternating current to pulsating direct current.

**HAZARDOUS LOCATION**—An area where ignitable vapors or dust may cause a fire or explosion created by energy emitted from lighting or other electrical equipment.

**HIGH-INTENSITY DISCHARGE LAMPS**—A general group of lamps consisting of mercury, metal halide, and high-pressure sodium lamps.

**HOLE FLOW**—In the valence band, a process of conduction in which electrons move into holes, thereby creating other holes that appear to move toward a negative potential. (The movement of holes is opposite the movement of electrons.)

**INDICATING DEVICE**—A device that indicates an alarm, supervisory, or trouble condition. Frequently, audible and visual devices, such as lamps and flashing lights, are used as indicating devices.

**INITIATING DEVICE**—A device used to initiate the sequence of electrical events that results in a detection or fire alarm or supervisory signal.

**INTEGRATED CIRCUIT**—A circuit in which many elements are fabricated and interconnected by a single process (into a single chip), as opposed to a “nonintegrated” circuit in which the transistors, diodes, resistors, and other components are fabricated separately and then assembled.

**IONIZE**—To convert totally or partially into ions (charged particles). This principle is used in some smoke detectors.

**LIGHT-EMITTING DIODE (LED)**—A PN-junction diode that emits visible light when it is forward biased. Depending on the material used to make the diode, the light may be red, green, or amber.

**LINE**—Strands of natural or synthetic fiber twisted together, sometimes referred to as rope.

**LUMEN**—The unit of light output or light flux. A 1-candlepower light source in the center of a hollow sphere 2 feet in diameter delivers 1 footcandle of light at every point on the inner surface of the sphere. Since the inside surface of the sphere is 12.57 square feet, the light source produces 12.57 lumens. However, to allow for losses, common practice puts the ratio of lumens to candle power at 10 to 1.

**LUMINAIRE**—A complete lighting unit consisting of a lamp or lamps together with the parts designed to distribute the light, to position and protect the lamps, and to connect the lamps to the power supply.

**MAINTENANCE**—Day-to-day, periodic, or scheduled work required to preserve or restore a facility or equipment so that it can be effectively used for its designed purpose. It includes work to prevent damage to or the deterioration of a facility that would otherwise be more costly to restore.

**MAINTENANCE FACTOR**—A factor used to denote the ratio of the illumination on a given area after a period of time to the initial illumination on the same area.

**METAL HALIDE LAMP**—A discharge lamp in which light is produced by the radiation from a mixture of a metallic vapor (such as mercury) and the products of the disassociation of halides (such as halides of thallium, indium, or sodium).

**MOUNTING HEIGHT (ROADWAY)**—The vertical distance between the roadway surface and the center of the light source.

**MOUSING**—Turns of cordage around the opening of a block hook.

**NPN**—A type of transistor that is formed by introducing a thin region of P-type material between two regions of N-type material.

**OVERHANG**—The horizontal distance between a vertical line passing through the luminaire and the curb or edge of the roadway.

**PHOTOCELL**—A light-controlled variable resistor that has a light-to-dark resistance ratio of 1:1,000. Used in various types of control and timing circuits.

**PHOTOMETER**—An instrument that measures luminous intensity or brightness, luminous flux, or light distribution.

**PNP**—A type of transistor that is formed by introducing a thin region of N-type material between two regions of P-type material.

**PRINTED CIRCUIT BOARD**—A flat insulating surface upon which printed wiring and miniaturized components are connected in a predetermined design and attached to a common base.

**RECTIFIER**—A device that by its conduction characteristics converts alternating current to a pulsating direct current.

**REEVING**—Threading or placement of a working line.

**REFLECTOR**—A device used to change the direction of the light rays and redirect them in the desired direction.

**REFRACTOR**—A transparent medium that passes light rays but bends or deflects them in the desired direction to obtain proper light distribution.

**REVERSE BIAS**—A condition in which an external voltage is applied to a PN-junction so that the junction offers a high resistance to current flow.

**RUNWAY THRESHOLD**—The beginning of the runway usable for landing.

**SHEAVE**—(Pronounced “shiv”) A grooved wheel or pulley used to support a cable or rope.

**SILICON-CONTROLLED RECTIFIER (SCR)**—A semiconductor device that functions as an electrically controlled switch.

**SOLID-STATE DEVICE**—An electronic device that operates by the movement of electrons within a solid piece of semiconductor material.

**STREETLIGHTING LUMINAIRE**—A complete lighting device consisting of the light source, globe, reflector, refractor, housing, and support. The pole, post, or bracket is not considered part of the luminaire.

**TRANSISTOR**—A semiconductor device with three or more elements.

**TRIAC**—A three-terminal device that is similar to two SCRs back to back with a common gate and common terminals. Although similar in

construction and operation to the SCR, the triac controls and conducts current flow during both alternations of an alternating current cycle.

**UNIJUNCTION TRANSISTOR (UJT)**—A three-terminal, solid-state device that resembles a transistor but is stable over a wide range of temperatures and allows a reduction of components when used in place of a transistor. It is used in switching circuits, oscillators, and wave-shaping circuits.

**VISUAL APPROACH SLOPE INDICATOR SYSTEM (VASIS)**—A system of angle-of-approach lights consisting of two bars of lights on each side of the runway near the threshold. These lights show red and white or a combination of both (pink) to the approaching pilot, depending upon the position of the aircraft with respect to the glide path.

**WIRE ROPE**—A rope formed of wires wrapped around a central core—a steel cable.

**ZENER DIODE**—A PN-junction diode designed to operate in the reverse-bias breakdown region.

**ZONE**—An area or division of a building protected by one fire alarm initiating circuit. Sometimes the area and the circuit are referred to interchangeable as the zone. The fire alarm initiating circuit may be connected to represent a certain group of initiating devices instead of a particular area or division of the building.

**APPENDIX II**

**FORMULAS AND CONVERSION TABLES**

# FORMULAS

## CONVERSION FACTORS AND CONSTANTS

$$\begin{aligned}\pi &= 3.14 & 2\pi &= 6.28 \\ \pi^2 &= 9.87 & (2\pi)^2 &= 39.5 \\ \varepsilon &= 2.718 & \sqrt{2} &= 1.414 \\ \sqrt{3} &= 1.732 & \text{LOG} &= 0.497\end{aligned}$$

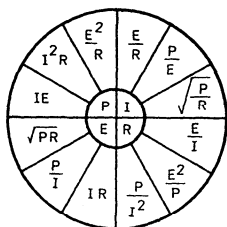
### Temperature

$$\begin{aligned}(\text{F to C}) \quad C &= 5/9 (\text{F} - 32) \\ (\text{C to F}) \quad F &= 9/5 C + 32 \\ (\text{C to K}) \quad K &= C + 273\end{aligned}$$

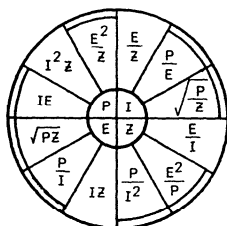
### Power

$$\begin{aligned}1 \text{ kilowatt} &= 1.341 \text{ horsepower} \\ 1 \text{ horsepower} &= 746 \text{ watts}\end{aligned}$$

## OHM'S LAW - DIRECT CURRENT



## OHM'S LAW - ALTERNATING CURRENT

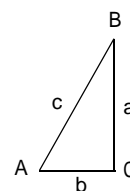


## SINUSOIDAL VOLTAGES AND CURRENTS

$$\begin{aligned}\text{Effective Value} &= 0.707 \times \text{Peak Value} \\ \text{Average Value} &= 0.637 \times \text{Peak Value} \\ \text{Peak Value} &= 1.414 \times \text{Effective Value} \\ \text{Effective Value} &= 1.11 \times \text{Average Value} \\ \text{Peak Value} &= 1.57 \times \text{Average Value} \\ \text{Average Value} &= 0.9 \times \text{Effective Value}\end{aligned}$$

## TRIGONOMETRIC FORMULAS

$$\begin{aligned}\sin A &= \frac{a}{c} = \frac{\text{Opposite Side}}{\text{Hypotenuse}} \\ \cos A &= \frac{b}{c} = \frac{\text{Adjacent Side}}{\text{Hypotenuse}} \\ \tan A &= \frac{a}{b} = \frac{\text{Opposite Side}}{\text{Adjacent Side}} \\ \cot A &= \frac{b}{a} = \frac{\text{Adjacent Side}}{\text{Opposite Side}}\end{aligned}$$



## SPEED VS. POLES FORMULAS

$$F = \frac{NP}{120} \quad N = \frac{F 120}{P} \quad P = \frac{F 120}{N}$$

F = frequency

N = speed of rotation

P = number of poles

120 = time constant

## POWER FACTOR

$$\text{PF} = \frac{\text{actual power}}{\text{apparent power}} = \frac{\text{watts}}{\text{volts} \times \text{amperes}} = \frac{\text{kW}}{\text{kVA}} = \frac{R}{Z}$$

### SINGLE-PHASE CIRCUITS

$$\text{kVA} = \frac{EI}{1,000} \quad \frac{\text{kW}}{\text{PF}} \quad \text{kW} = \text{kVA} \times \text{PF}$$

$$I = \frac{P}{E \times \text{PF}} \quad E = \frac{P}{I \times \text{PF}} \quad \text{PF} = \frac{P}{E \times I}$$

$$P = E \times I \times \text{PF}$$

### TWO-PHASE CIRCUITS

$$I = \frac{P}{2 \times E \times \text{PF}} \quad E = \frac{P}{2 \times I \times \text{PF}} \quad \text{PF} = \frac{P}{E \times I}$$

$$\text{kVA} = \frac{2 \times E \times I}{1,000} = \frac{\text{kW}}{\text{PF}} \quad \text{kW} = \text{kVA} \times \text{PF}$$

$$P = 2 \times E \times I \times \text{PF}$$

### THREE-PHASE CIRCUITS, BALANCED WYE

$$I_{\text{phase}} = I_{\text{line}}$$

$$E_P = \frac{E_L}{\sqrt{3}} = 0.577 E_L$$

### THREE-PHASE CIRCUITS, BALANCED DELTA

$$E_{\text{phase}} = E_{\text{line}}$$

$$I_L = \sqrt{3} I_P = 1.73 I_P$$

$$I_P = \frac{I_L}{\sqrt{3}} = 0.577 I_L$$

### POWER: THREE-PHASE BALANCED WYE OR DELTA CIRCUITS

$$P = 1.732 \times E \times I \times \text{PF} \quad \text{VA} = 1.732 \times E \times I$$

$$E = \frac{P}{\text{PF} \times 1.73 \times I} = \frac{0.577 \times P}{\text{PF} \times I}$$

$$I = \frac{P}{\text{PF} \times 1.73 \times E} = \frac{0.577 \times P}{\text{PF} \times E}$$

$$\text{PF} = \frac{P}{1.73 \times I \times E} = \frac{0.577 \times P}{I \times E}$$

VA = apparent power (volt-amperes)

P = actual power (watts)

E = line voltage (volts)

I = line current (amperes)

# CONVERSION TABLES

## LENGTH CONVERSION

When You Know:	You Can Find:	If You Multiply By:
inches	millimeters	25.4
inches	centimeters	2.54
feet	centimeters	30
feet	meters	0.3
yards	centimeters	90
yards	meters	0.9
miles	kilometers	1.6
miles	meters	1 600
millimeters	inches	0.04
centimeters	inches	0 4
centimeters	feet	0.032 8
meters	feet	3 3
centimeters	yards	0.010 9
meters	yards	1.1
meters	miles	0:000 621
kilometers	miles	0.6
meters	nautical miles	0.000 54
nautical miles	meters	1 852

## VOLUME CONVERSION

When You Know:	You Can Find:	If You Multiply By:
teaspoons	milliliters	5
tablespoons	milliliters	15
fluid ounces	milliliters	30
cups	liters	0.24
pints	liters	0.47
quarts	liters	0.95
gallons	liters	3.8
milliliters	teaspoons	0.2
milliliters	tablespoons	0.067
milliliters	fluid ounces	0.034
liters	cups	4.2
liters	pints	2.1
liters	quarts	1.06
liters	gallons	0.26
cubic feet	cubic meters	0.028
cubic yards	cubic meters	0.765
cubic meters	cubic feet	35.3
cubic meters	cubic yards	1.31



## CONVERSION TABLES—CONTINUED

### WEIGHT CONVERSION

When You Know:	You Can Find:	If You Multiply By:
ounces	grams	28.3
pounds	kilograms	0.45
short tons (2,000 lbs)	megagrams (metric tons)	0.9
grams	ounces	0.035 3
kilograms	pounds	2.2
megagrams (metric tons)	short tons (2,000 lbs)	1.1

### TEMPERATURE CONVERSION

When You Know:	You Can Find:	If You
degrees Fahrenheit	degrees Celsius	subtract 32 then multiply by 5/9
degrees Celsius	degrees Fahrenheit	multiply by 9/5 then add 32
degrees Celsius	kelvins	add 273.15°

### AREA CONVERSION

When You Know:	You Can Find:	If You Multiply By:
square inches	square centimeters	6.45
square inches	square meters	0.000 6
square feet	square centimeters	929
square feet	square meters	0.092 9
square yards	square centimeters	8 360
square yards	square meters	0.836
square miles	square kilometers	2 6
square centimeters	square inches	0.155
square meters	square inches	1 550
square centimeters	square feet	0.001
square meters	square feet	10.8
square centimeters	square yards	0.000
square meters	square yards	1.2
square kilometers	square miles	0.4



## APPENDIX III

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